ANALYSES OF SELECTED SHIPMENTS OF U.S. AND OTHER SOYBEANS RECEIVED IN JAPAN, 1972-76

ARS-NE-92
1978

AGRICULTURAL RESEARCH SERVICE • U.S. DEPARTMENT OF AGRICULTURE

PREFACE

This report is part of a broader study to identify in detail the type, extent, and causes of physical losses and damage and to determine quality deterioration in U.S.-grown soybeans in the various shipping, handling, and processing steps and transport modes by laboratory analyses and experiments. The report covers reported exploratory research to identify the amounts and types of condition, quality, and weight losses in U.S.-grown soybeans shipped to Japan.

The data developed in this phase of the project will provide the basis for identifying and selecting alternative equipment, handling techniques, and improvements in transport, handling, and storage environments which may reduce quality and weight losses.

The quality and weight losses of U.S.-grown soybeans are, to a certain extent, peculiar to the discriminating requirements of a specific Japanese market. However, many problems discussed in this report are common to all soybean receivers regardless of their geographical location.

The American Soybean Association has assisted and supported this research from the beginning. The staff of its Tokyo office, led by Jack Yamachita, was helpful in developing the primary sources for the data presented in this report. Personnel of the Foreign Agricultural Service were also helpful in this effort. Scott Hartman, Supervisory Grain Inspector, Federal Grain Inspection Service, accompanied the researchers overseas and provided guidance and advice. The services of A. Hinokuma, President of the Japan Oil Stuff Inspectors Corporation, were helpful to U.S. researchers in numerous ways.

CONTENTS

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SUMMARY

The information in this report, based on interviews with Japanese soybean importers and processors, was developed in 1975 and 1976. The analyses of selected shipments of U.S.-grown soybean shipments were supplied by Japanese researchers. (Comparison is made of some U.S. soybeans with those received in Japan, from Brazil and Peoples' Republic of China.)

The 5-year (1972-76) period covered showed that the foreign material (FM) and physical damage to soybeans were not substantial problems in shipments of U.S.-grown soybeans to Japan. Although split unloading of shipments caused some problems with the distribution of FM in different lots of soybeans, none of the shipments taken as a whole exceeded the Japanese allowable limits for the same proportion of FM. Most Japanese receivers expressed some dissatisfaction with the quantity of FM in the shipments they received; however, they were primarily concerned with the oil content and protein (nitrogen) content of the soybeans, weight shortages, and insect infestations.

The Japanese importers mostly commented on the low oil content of the U.S. soybeans in comparison with that of the Brazilian soybeans. They wanted soybeans containing over 19 percent of oil. In most cases the oil content of U.S. soybean shipments sampled in 1973-76 was under 19 percent, whereas, in the Brazilian soybean shipments, it averaged over 20 percent.

The quality of soybean meal is directly related to the amount of protein in the soybeans. Less than 5.8 percent protein content has a serious effect on the suitability of soybean meal for animal feed and for human food. The higher the protein content in the soybean meal, the greater the food value of the meal.

The presence of poisonous seeds, such as morningglory and crotalaria, among soybeans requires that additional steps be taken by oil processors to remove the seed residues. Most U.S. shipments contained poisonous seeds in greater quantity than the legal Japanese limit.

Japanese customs inspectors frequently found insect infestation which required fumigation of an entire ship. The fumigation not only caused a 2-day delay in unloading the ship, but also entailed additional expenses.

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The Japanese receivers of U.S. soybeans generally mentioned weight shortages. Even with exceptions made for changes in moisture content due to variations in climatic conditions and legitimate scale tolerances, the weight shortages reported for U.S. soybean shipments during the 5-year period (1972-76) were significant and a costly burden to the receiver.

The principal advantages Brazilian soybeans have had in the past over U.S. soybeans were higher oil content and less foreign material. The disadvantage of the Brazilian soybeans is their reddish color acquired from the soil, which shows up in the meal and adversely affects its quality. Furthermore, Brazil has not been as dependable a soybean supply source as the United States. Although Brazilian and U.S. soybeans may have the same f.o.b. selling price at any one time, transport charges for comparable shipments of Brazilian soybeans are higher.

The Chinese soybeans' food grade and the amount of foreign material compared favorably with U.S. soybeans. Only a limited amount of Chinese soybeans is available for export, and since 1975 the supply has been more limited.

INTRODUCTION

Foreign buyers' complaints on the quality and condition of U.S.-grown grain and soybeans upon arrival at overseas markets have been the subject of some discussion and controversy. The U.S. Department of Agriculture (USDA) undertook a study of the losses in the transport and handling of soybeans to overseas Japanese receivers to determine the nature and extent of damage and quality losses.

The information in this report was developed in 1975 and 1976 during a survey of soybean importers and processors in Japan. Numerous receivers at grain elevators and at oil-processing mills who were interviewed expressed their concern about the condition and quality of U.S.-grown soybeans. Most of the complaints did not pertain to the foreign material (FM), poisonous seeds, insect infestation, and split beans, but rather, to the oil and protein content--two factors to which the U.S. grade standards make no reference.

Some foreign receivers' complaints were supported by data provided the Japanese researchers, receivers, and processors. The other complaints are reported here only as opinions expressed by the Japanese receivers during personal interviews.

Most of the information in this report is unusual, because foreign receivers' complaints have been rarely analyzed and evaluated. The extent of quality changes in soybeans between origin and destination is seldom documented. The causes of such quality changes are rarely studied, partly because of the difficulty in obtaining the required data. Some data presented were gathered by sampling methods not measuring up to U.S. statistical standards. However, these data are included because they may help in identifying some of the problems.

In the past, U.S. shippers at times apparently have not been sufficiently sensitive to foreign buyers' complaints. Many of the receivers interviewed in Japan expressed surprise that USDA should be researching problems in grain quality. These foreign receivers believed that the United States was indifferent to foreign complaints, because the country held such a dominant position in the world soybean market.

In their interviews Japanese researchers often referred to soybeans received from Brazil and China. Comparative analyses of soybeans from these countries, supplied by Japanese researchers, are presented.

METHOD OF STUDY

In 1975 and 1976 personal interviews with Japanese officials of 43 companies included the management and technical personnel of grain elevators; crushing and processing oil mills; ocean carriers; trade associations; sampling, weighing, and surveying companies; grain brokers; and government procurement agencies. Most interviews were made on the researchers' initiative; others, on management's invitation. The purpose of these visits was to study the nature and significance of problems some receivers were reportedly having with U.S. soybeans. Documentation was obtained, where available, to determine if the available data supported comments about U.S. soybean shipments.

In addition to personal interviews, USDA personnel visited grain elevators and unloading port facilities, studied unloading of U.S. soybean shipments, and observed various handling and transport methods from dockside at the origin port to final destination.

Japanese researchers compiled the data presented in the following tables and provided the composition and analyses of the soybean shipments received. Names of specific consignees or receiving grain elevators were not given to protect their identity. General soybeans, where mentioned in the text, refers to those soybeans used primarily for crushing, and special or food grade soybeans are those used directly for human consumption, as used by the Japanese in various curds, such as miso and natto.

FOREIGN MATERIAL

Foreign material (FM) is described as all matter, including soybeans and pieces of soybeans, that will pass readily through an 8/64-inch round grain dockage sieve and all matter other than soybeans remaining on such sieve after sieving.

The large amount of foreign material in U.S. grain shipments reportedly has been a subject of considerable concern to the overseas receivers. This is especially true for U.S. soybeans shipped to Japan which were processed for oil, because foreign materials interfere with the operation in the crushing plant and often reduce the oil quality. Most Japanese receivers desired shipments of U.S. soybeans with less than 1.5 percent FM. The FM in most of the

shipments were within the tolerances of U.S. grade standards--2 percent FM for grade 2 yellow soybeans. Nevertheless, the soybeans required a costly cleaning process.2/

Most, if not all, U.S. soyhean shipments to Japan were unloaded at more than one port and for more than one receiver. Foreign material and broken (splits) soybeans and whole soybeans generally were subjected to the process of natural separation during loading. Thus at loading, the FM and splits, generally lighter in weight than the whole soybeans, would separate and move toward the sides of the ship's hold. Consequently, at unloading, the first receiver frequently received a smaller percentage of FM and splits than the last receiver.

Table 1 shows analyses of 14 selected soybean shipments unloaded at various ports in Japan in 1975-76. An increase of three and four times the amount of FM from one unloading elevator to another for the same shipment is shown. These variations in the percentages of FM in successive unloadings of the same lots of soybeans can be explained by the tendency for FM to segregate because of the uneven distribution throughout the load mass. This natural separation of FM from the whole soybeans means that during unloading most of the finer FM tends to go to the sides and away from the center of the ship's hold. For example, in ship No. 1 there were only 1.17 percent FM at the first unloading elevator, 4.64 percent FM at the second, and 0.55 percent at the third. The data in this table also indicate the variability in FM where there were multiple ports of unloading.

Table 2 shows 20 shipments of soybeans received over an 8-month period (July 1975 to February 1976). For all lots of soybeans, the foreign material in these shipments ranged from a low of 1.07 percent to a high of 2.65 percent. This range occurred in part because of successive unloadings of different lots of soybeans from the same shipments. However, since the data in tables 1 and 2 indicate that FM for most shipments was generally less than 2.0 percent, FM was not a serious problem. Personal interviews with elevator personnel and oil mill operators confirmed this conclusion. Although the foreign materials hampered oil mill operations, the processors were more concerned about the alleged low oil content, low protein content, and insect infestation of U.S. shipments than about the amount of FM.

OIL AND PROTEIN CONTENT

In personal interviews, most Japanese importers complained about the low oil and protein content of U.S. soybeans. All receivers desired soybeans with 19 percent or greater oil content and over 5.8 percent of total protein content.

2/ Over 90 percent of the soybean shipments to Japan are bought and shipped on an appealed basis, which requires an inspection and determination of grade by the Federal Grain Inspection Service, USDA.

The quality of soybean meal is directly related to the amount of protein. Low protein content has a serious effect on the suitability of soybeans for meal as animal feed and human food. The higher the protein, the greater the food value of the meal.

Storage and blending practices in marketing soybeans made it impossible to identify in quality analyses the specific variety of the soybeans or even their geographical area of production. The only measure of comparison was the year in which the soybeans were produced.

Tables 3, 4, and 5 present analyses of U.S. soybeans received by three oil elevators in Japan. Oil content ranged from a low of 17.28 to 19.31 percent, and total nitrogen content ranged from 5.47 to 5.98 percent. The oil content is low, especially when compared with the Brazilian soybeans, as shown in section "Comparison of Soybeans from Brazil and China."

POISONOUS SEEDS AND INSECT INFESTATION

The Japanese receivers frequently mentioned the amount of poisonous seeds, such as morningglory and crotalaria, found in the soybean shipments. When morningglory seeds were present in different lots of soybeans, the oil derived from crushing had to be further processed to remove the seeds or their residues. This was a costly and time-consuming process. In 17 shipments of U.S. soybeans received by Elevator F (table 6) over a period of 3 years, morningglory seeds ranged from 0.09 to 0.39 percent. At another elevator (A) morningglory seeds ranged from 0.0 to 0.25 percent (table 7). The Japanese legal limit for morningglory seeds is 0.07 percent, and Japanese regulations require that the processing mill remove the excess seeds before final processing.

Three Japanese importers stated during interviews that 90 percent of U.S. soybean shipments were infested with insects. Upon arrival, if the Japanese customs inspectors of the ship detected even a single moth or other insect, the whole ship was subjected to fumigation. This step involved a 2-day delay in unloading the soybeans and about a $200 charge to the receiver. Most soybeans shipped to Japan are loaded in warm and humid U.S. Gulf ports of embarkation where conditions are conducive to insect infestation.

WEIGHT ANALYSES

As explained to the Japanese receivers, some of the weight shortages possibly could have been caused by split deliveries of the shipments, where each successive receiver may have received less weight of soybeans.

Table 8 shows weight analyses of 35 soybean shipments received over a 12-month period in 1974, with a total weight loss of 0.90 percent. Some of these weight variabilities occur because of changes in the moisture content of the soybeans between origin and destination where atmospheric moisture varies. In others, weight variations can result from legitimate scale tolerances, the legal tolerance for error being one-tenth of 1 percent.

Table 1.--Analyses of 14 selected shipments of U.S. soybeans unloaded at 32 Japanese ports, 1975-76 1/

Ship no. and order of unloading	Unloaded weight	Foreign material	Damaged beans	Splits 2/	Moisture content 3/	Oil content 3/	Nitrogen content 3/
	Metric tons	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Ship no. 1--							
First unloading	17,700	1.17	0.58	9.89	12.81	18.01	5.50
Second unloading	1,850	4.64	--	--	12.90	18.14	5.60
Third unloading	1,996	.55	1.33	--	12.70	18.16	5.15
Ship no. 2--							
First unloading	19,461	1.12	--	--	12.50	18.13	5.74
Second unloading	10,853	1.89	.91	--	12.50	18.03	5.67
Third unloading	927	3.66	--	--	--	--	--
Ship no. 3--							
First unloading	3,315	1.98	.76	--	11.20	19.86	5.59
Second unloading	1,781	3.17	--	--	11.30	19.78	5.86
Ship no. 4--							
First unloading	15,342	1.18	1.20	--	12.00	19.68	5.73
Second unloading	16,328	1.12	--	--	12.40	19.57	5.75
Ship no. 5--							
First unloading	16,862	1.18	--	--	12.10	18.88	5.70
Second unloading	17,200	1.72	.74	8.59	11.98	19.12	5.67
Ship no. 6--							
First unloading	14,872	1.45	--	--	11.20	18.23	5.74
Second unloading	15,051	1.17	--	--	10.20	18.51	5.82
Ship no. 7--							
First unloading	7,879	2.47	--	--	11.90	18.29	5.61
Second unloading	8,077	1.40	--	--	11.50	18.59	5.67

Ship no. 8--							
First unloading	14,059	2.09	--	--	11.80	18.05	5.78
Second unloading	13,075	1.40	--	--	10.60	18.11	5.93
Ship no. 9--							
First unloading	4,980	1.84	--	8.00	12.85	18.16	5.95
Second unloading	641	3.76	--	--	12.70	18.50	5.83
Ship no. 10--							
First unloading	21,703	1.91	--	--	12.40	18.27	5.72
Second unloading	35,102	1.49	1.02	7.78	12.48	18.03	5.63
Ship no. 11--							
First unloading	31,458	1.82	1.07	11.26	12.63	18.04	5.66
Ship no. 12--							
First unloading	28,584	1.80	1.05	11.25	12.61	18.63	5.64
Ship no. 13--							
First unloading	30,141	1.43	2.97	7.54	11.76	18.15	5.70
Second unloading	5,131	1.84	--	--	11.80	17.89	5.81
Ship no. 14--							
First unloading	20,239	.98	--	--	11.30	18.60	5.60

1/ All percentage data in this table represent a percentage of the total weight of soybeans.

2/ A grade variable in U.S. Grain Inspection Manual defined as a soybean with more than one-fourth broken off.

3/ Data are on an "as is" or "wet" basis. To convert nitrogen to protein, multiply by a factor of 6.25. Oil and nitrogen content data are on an "as is" basis, i.e., soybeans containing moisture content as shown under the heading of moisture.

Source: All data in this table supplied by Japanese elevators and crushing mills.

Table 2.--Analyses of samples of 20 selected shipments of soybeans received in Japan for 8-month period (1975-76) 1/

Ship no.	Unloaded weight	Foreign material	Damaged beans	Splits 2/	Moisture content 3/	Oil content 3/	Nitrogen content 3/	Test weight
	Metric tons	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Pounds*
1	10,260	1.39	2.34	10.43	12.04	18.21	5.73	56.1
2	23,635	1.43	4.02	8.90	11.05	18.29	5.70	56.0
3	23,491	1.53	3.00	9.18	11.79	18.35	5.66	56.3
4	10,178	1.65	2.08	8.91	10.89	18.45	5.75	56.0
5	34,850	1.52	1.95	9.06	11.37	18.64	5.74	56.4
6	42,642	1.51	4.15	8.22	11.72	18.35	5.63	56.5
7	30,141	1.43	2.97	7.54	11.76	18.15	5.70	56.5
8	25,644	2.65	5.41	14.05	11.15	17.90	5.77	56.8
9	24,176	1.48	3.09	9.13	11.23	18.37	5.73	56.5
10	29,267	1.34	2.75	6.01	12.25	19.37	5.66	55.7
11	22,775	1.12	2.30	5.93	12.27	19.05	5.70	55.6
12	15,841	1.37	1.63	8.17	11.39	19.56	5.81	55.3
13	30,855	1.74	.74	8.61	11.97	19.11	5.67	55.6
14	21,683	1.17	1.17	9.35	11.98	18.82	5.67	56.0
15	21,791	1.23	1.52	8.78	11.18	19.41	5.82	55.6

16	31,315	1.07	.70	6.56	12.25	18.36	5.65	56.4
17	35,102	1.49	1.02	7.78	12.48	18.03	5.63	56.1
18	28,345	1.17	.59	9.89	12.79	18.00	5.51	55.5
19	31,568	1.82	1.07	11.26	12.63	18.04	5.66	55.8
20	28,584	1.80	1.05	11.25	12.61	18.63	5.64	55.3

1/ All percentage data in this table represent a percentage of the total weight of soybeans.

2/ A grade variable in U.S. Grain Inspection Manual defined as a soybean with more than one-fourth broken off.

3/ Data are on an "as is" or "wet" basis. To convert nitrogen to protein, multiply by a factor of 6.25. Oil and nitrogen content data are on an "as is" basis, i.e., soybeans containing moisture content as shown under the heading of moisture.

Source: All data in this table supplied by Japanese elevators and crushing mills.

Table 3.--Analyses of soybean samples received at Elevator C in Japan, 1975-76 1/

Year	Ship no.	Unloaded weight	Foreign material	Damaged beans	Splits 2/	Moisture content 3/	Oil content 3/	Nitrogen content 3/
		Metric tons	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1975	1	9,143	1.76	8.4	6.9	10.96	18.21	5.82
1975	2	2,864	1.46	3.8	9.4	11.92	18.10	5.98
1975	3	1,971	1.29	3.3	10.1	13.00	18.36	5.97
1975	4	473	1.75	7.4	12.1	11.36	18.44	5.84
1975	5	7,520	1.56	2.5	14.9	13.16	17.91	5.96
1975	6	7,614	3.53	2.8	12.1	11.92	18.16	5.96
1975	7	1,423	3.09	4.9	11.6	12.10	18.33	5.91
1975	8	6,124	1.16	3.5	12.4	12.08	18.17	5.91
1975	9	4,996	.73	3.2	12.9	12.01	18.16	5.94
1975	10	8,625	1.47	3.4	12.0	11.52	18.32	5.95
1975	11	6,178	1.51	4.8	11.7	11.32	18.37	5.96
1975	12	751	1.54	3.7	11.0	11.38	18.60	5.91
1976	13	4,980	1.84	3.5	8.0	12.85	18.16	5.95

1976	14	4,886	2.77	3.0	9.9	12.81	17.38	5.89
1976	15	8,614	1.16	3.3	9.5	12.76	17.78	5.94

1/ All percentage data in this table represent a percentage of the total weight of soybeans.

2/ A grade variable in U.S. Grain Inspection Manual defined as a soybean with more than one-fourth broken off.

3/ Data are on an "as is" or "wet" basis. To convert nitrogen to protein, multiply by a factor of 6.25. Oil and nitrogen content data are on an "as is" basis, i.e., soybeans containing moisture content as shown under the heading of moisture.

Source: All data in this table supplied by Japanese elevators and crushing mills.

Table 4.--Analyses of soybean samples received at Elevator E in Japan, 1975 1/

Ship no.	Unloaded weight	Foreign material	Damaged beans	Splits 2/	Moisture content 3/	Oil content 3/	Nitrogen content 3/
	Metric tons	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1	3,996	1.15	2.38	8.21	11.84	18.36	5.67
2	3,819	1.20	3.93	7.10	12.00	18.20	5.66
3	3,819	1.68	1.89	7.71	11.95	18.22	5.65
4	3,996	1.90	2.23	7.38	11.83	18.33	5.66
5	4,098	1.36	2.70	6.63	11.94	18.41	5.65
6	3,979	1.64	2.23	6.56	12.03	18.40	5.66
7	4,098	1.19	2.69	7.22	11.77	18.63	5.64
8	4,098	1.18	1.92	6.54	11.53	18.63	5.68
9	4,098	1.84	2.32	10.00	11.41	18.98	5.73
10	2,662	1.68	2.36	8.31	11.49	18.36	5.73
11	3,996	1.96	3.38	11.09	11.37	18.01	5.71
12	3,819	1.87	4.39	10.60	11.10	18.07	5.71
13	5,381	1.53	3.02	11.46	11.70	18.04	5.73
14	4,698	1.96	.76	9.79	12.06	19.05	5.65
15	4,098	1.81	.65	8.32	11.85	19.02	5.73

16	5,206	1.44	.80	7.71	12.00	19.25	5.63
17	4,098	1.16	.58	10.22	12.81	18.05	5.51
18	4,098	1.12	.79	9.57	12.28	18.04	5.57
19	4,098	1.26	.54	10.73	13.06	18.03	5.50
20	5,645	1.15	.43	9.04	12.99	17.88	5.47

1/ All percentage data in this table represent a percentage of the total weight of soybeans.

2/ A grade variable in U.S. Grain Inspection Manual defined as a soybean with more than one-fourth broken off.

3/ Data are on an "as is" or "wet" basis. To convert nitrogen to protein, multiply by a factor of 6.25. Oil and nitrogen content data are on an "as is" basis, i.e., soybeans containing moisture content as shown under the heading of moisture.

Source: All data in this table supplied by Japanese elevators and crushing mills.

Table 5.--Analyses of soybean samples received at Elevator D in Japan, 1974-76 1/

Year	Ship no.	Unloaded weight	Foreign material	Damaged beans	Splits 2/	Moisture content 3/	Oil content 3/	Nitrogen content 3/
		Metric tons	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1974	1	16,399	1.85	4.7	10.5	11.86	17.51	5.70
1974	2	24,495	1.66	8.2	9.7	12.00	17.96	5.75
1974	3	17,995	1.66	3.2	10.3	12.64	18.12	5.68
1974	4	13,283	2.36	6.6	10.0	12.15	18.07	5.70
1974	5	12,394	1.78	6.3	11.2	11.38	18.28	5.64
1974	6	20,958	1.68	5.3	10.4	11.22	18.15	5.77
1974	7	16,585	1.58	4.7	10.3	10.91	17.71	5.77
1974	8	2,163	1.24	7.3	8.6	11.58	18.92	5.66
1974	9	21,451	1.14	4.3	9.2	11.85	19.31	5.79
1975	10	22,128	1.33	5.5	11.3	11.95	18.72	5.87
1975	11	17,700	1.48	1.1	9.4	11.41	18.85	5.81
1975	12	22,540	2.11	6.5	14.5	11.93	19.28	5.78
1975	13	4,135	1.11	3.7	13.0	11.49	19.14	5.89
1975	14	17,035	1.62	5.8	15.4	11.66	19.12	5.85
1975	15	11,520	1.85	3.6	14.4	11.51	19.25	5.85

1975	16	16,153	1.75	5.5	16.9	12.37	19.23	5.76
1975	17	368	3.74	3.8	8.7	11.95	18.04	5.97
1975	18	17,936	1.65	3.0	13.5	11.67	18.72	5.83
1976	19	16,663	1.52	4.9	8.9	11.84	19.31	5.69
1976	20	15,652	1.20	3.8	8.0	12.33	17.99	5.70
1976	21	6,347	1.66	3.3	13.0	12.98	17.28	5.98
1976	22	14,479	1.62	5.3	10.1	12.20	17.91	5.71

1/ All percentage data in this table represent a percentage of the total weight of soybeans.

2/ A grade variable in U.S. Grain Inspection Manual defined as a soybean with more than one-fourth broken off.

3/ Data are on an "as is" or "wet" basis. To convert nitrogen to protein, multiply by a factor of 6.25. Oil and nitrogen content data are on an "as is" basis, i.e., soybeans containing moisture content as shown under the heading of moisture.

Source: All data in this table supplied by Japanese elevators and crushing mills.

Table 6.--Analyses of soybean samples received at Elevator F in Japan, 1974-76 1/

Year	Ship no.	Unloaded weight	Foreign material	Morning-glory seeds	3.5 mesh 2/	Moisture content 3/	Oil content 3/	Nitrogen content 3/
		Metric tons	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1974	1	9,923	1.89	0.17	36.7	11.8	18.83	5.71
1975	2	22,692	6.36	.17	51.3	11.5	18.42	5.68
1975	3	19,832	2.49	.30	27.0	11.9	17.22	5.73
1975	4	7,950	1.24	.22	25.5	12.4	17.05	5.68
1975	5	5,344	1.31	.21	31.6	12.6	17.65	5.70
1975	6	14,851	1.36	.27	31.0	12.3	17.91	5.62
1975	7	14,859	2.09	--	47.7	11.8	18.05	5.78
1975	8	7,978	2.47	.21	46.8	11.9	18.29	5.61
1975	9	11,964	1.90	.19	35.5	11.7	18.14	5.68
1975	10	14,872	1.45	.16	35.9	11.2	18.23	5.74
1975	11	9,029	.89	.09	38.7	11.2	18.50	5.74
1975	12	5,131	1.84	.31	31.6	11.8	17.89	5.81
1975	13	7,554	1.91	.10	33.6	11.2	18.29	5.73
1975	14	16,328	1.12	.12	40.4	12.4	19.57	5.75
1975	15	16,862	1.18	.18	47.6	12.1	18.88	5.70

1976	16	19,461	1.12	.39	31.3	12.5	18.13	5.74
1976	17	21,703	1.91	.33	26.4	12.4	18.27	5.72

1/ All percentage data in this table represent a percentage of the total weight of soybeans.

2/ Grain dockage sieve meeting U.S. Bureau of Standards requirements as to sizes or opening and wire diameter.

3/ Data are on an "as is" or "wet" basis. To convert nitrogen to protein, multiply by a factor of 6.25. Oil and nitrogen content data are on an "as is" basis, i.e., soybeans containing moisture content as shown under the heading of moisture.

Source: All data in this table supplied by Japanese elevators and crushing mills.

Table 7.--Analyses of soybean samples received at Elevator A in Japan, 1974-76 1/

Year	Ship no.	Unloaded weight	Foreign material	Morning-glory seeds	Damaged beans	3.5 mesh 2/	Moisture content 3/	Oil content 3/	Nitrogen content 3/
		Metric tons	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1974	1	6,784	0.66	--	1.06	62.5	11.3	19.36	5.69
1974	2	3,938	1.50	--	.44	62.0	11.7	18.88	5.85
1974	3	4,465	.40	--	.12	41.8	11.0	20.71	5.72
1974	4	10,938	1.85	--	.68	43.4	12.0	18.13	5.68
1975	5	13,599	1.95	--	.57	46.9	11.8	18.09	5.78
1975	6	16,582	1.12	--	.56	42.9	12.0	18.11	5.68
1975	7	10,893	1.42	--	.20	38.7	12.3	17.74	5.79
1975	8	15,043	1.73	0.11	.45	41.2	12.4	17.77	5.72
1975	9	6,995	1.18	.12	.56	57.9	11.0	18.79	5.88
1975	10	13,075	1.40	0	.47	55.6	10.6	18.11	5.93
1975	11	3,426	.77	.06	.83	36.1	10.9	18.57	5.79
1975	12	8,077	1.40	.10	.24	55.0	11.5	18.59	5.67
1975	13	14,629	1.89	.10	.60	53.8	10.5	18.12	5.73
1975	14	15,051	1.17	.06	.41	47.9	10.2	18.51	5.82
1975	15	8,255	1.84	.10	.85	41.2	10.8	18.34	5.67

1975	16	9,746	.52	.12	.76	52.4	11.3	18.34	5.65
1975	17	20,239	.98	.06	1.05	53.6	11.3	18.60	5.60
1975	18	4,586	3.63	.11	1.69	54.0	12.0	19.45	5.72
1975	19	15,342	1.18	.05	1.20	45.5	12.0	19.68	5.73
1975	20	1,352	.92	.06	1.05	48.5	11.9	19.56	5.72
1975	21	13,882	1.98	.25	.76	46.2	12.0	18.80	5.59
1975	22	3,315	1.17	0	1.82	38.9	11.2	19.86	5.82
1976	23	10,854	1.89	.24	.91	39.0	12.5	18.03	5.67
1976	24	1,996	.55	.14	1.33	40.4	12.7	18.16	5.15

1/ All percentage data in this table represent a percentage of the total weight of soybeans.

2/ Grain dockage sieve meeting U.S. Bureau of Standards requirements as to sizes of opening and wire diameter.

3/ Data are on an "as is" or "wet" basis. To convert nitrogen to protein, multiply by a factor of 6.25. Oil and nitrogen content data are on an "as is" basis, i.e., soybeans containing moisture content as shown under the heading of moisture.

Source: All data in this table supplied by Japanese elevators and crushing mills.

Table 8.--Weight analyses of 35 U.S. (special) soybean shipments received in Japan, 1974 1/

Month	Number of ships	Unloaded weight Metric tons	Weight shortages Metric tons	Weight shortages Percentage
January	7	78,244	877	1.12
February	2	3,970	36	.92
March	2	8,606	160	1.86
April	4	45,143	266	...
May	3	18,047	291	1.62
June	3	38,033	297	.78
July	2	26,059	122	.47
August	3	26,154	227	.87
September	2	39,096	293	.75
October	2	25,500	194	.76
November	1	19,926	174	.87
December	4	75,358	695	.92
Total	35	404,136	3,632	.90

1/ Special, or food grade soybeans of higher quality and greater value, are usually shipped in small lots and their identity is preserved by separation when shipped with other soybeans.

Source: All data in this table supplied by Japanese elevators and weighing and inspection companies.

Table 9 shows weight data for shipments of general and special soybeans received in Japan, July-December, 1975. The weight discrepancies ranged from 0.02 to 0.91 percent.

Table 10 shows the consistency of the weight shortages of U.S. soybean shipments over a 5-year period. The data reflect a slight improvement in 1975 over those of 1972, 1973, and 1974.

Table 9.--Weight analyses of U.S. (general and special) soybean shipments received in Japan, (July-December) 1975 1/

Month	Number of ships	Unloaded weight Metric tons	Weight shortages Metric tons	Weight shortages Percentage
		General soybeans		
July	3	68,565	121	0.18
August	9	201,275	334	.17
September	8	230,562	574	.25
October	8	213,728	604	.28
November	11	304,192	1,058	.35
December	10	262,191	930	.35
Total	49	1,280,513	3,621	.28
		Special soybeans		
July	2	37,472	8	.02
August	2	22,780	155	.68
September	3	64,979	201	.31
October	1	24,688	205	.91
November	3	48,923	340	.70
December	5	98,121	570	.58
Total	16	296,963	1,479	.50
GRAND TOTAL	65	1,577,476	5,100	.32

1/ All soybeans cited in this report are in the "general" category unless specifically cited as "special." "Special," or food grade soybeans, are separated during shipment to preserve their identity, and they are higher priced.

Source: All data in this table supplied by Japanese elevators and weighing and inspection companies.

Table 10.--Weight analyses of U.S. soybean shipments received in Japan 1972-76

Year	Number of ships	Unloaded weight Metric tons	Weight shortages Metric tons	Weight shortages Percentage
1972	163	2,907,296	17,973	0.61
1973	175	3,002,571	24,135	.80
1974	143	2,805,505	19,066	.68
1975	128	2,937,394	10,819	.37
1976	156	3,202,800	10,777	.34

Source: All data in this table supplied by Japanese elevators and weighing and inspection companies.

Month-by-month weight analyses of 1974 U.S. soybean shipments are shown in table 11. For a total of 109 shipments consisting of 2,402,730 metric tons of soybeans, the total weight shortage was 15,445 metric tons. This amounted to only 0.64 percent of the total weight. Although the amount of the reported shortage does not appear to be very great, the monetary value of the shortage is substantial.

COMPARISON OF SOYBEANS FROM BRAZIL AND CHINA

In their comments, the Japanese importers frequently referred to soybeans from Brazil and China. For the purpose of establishing some of the differences and similarities between U.S. soybeans and their competition, the Japanese researchers collected 1973-76 comparative available data based on shipments of Brazilian soybeans from grain and elevator companies, oil (crushing) mills, and weighing inspection and sampling companies.

Table 12 shows analyses of nine shipments of Brazilian soybeans received in Japan in 1973-75. Foreign material data and oil content were most noticeable, because they represent an improvement over most U.S. soybean shipments. In both of these categories, Brazilian soybeans are competing effectively with U.S.-grown soybeans.

Table 13 shows analyses of U.S., Brazilian, and Chinese soybeans received in Japan in 1973-76. The Chinese soybeans, harvested primarily by hand, were of a food grade and compared favorably with U.S. soybeans only in the amount of foreign material; in oil and nitrogen content, U.S. soybeans were preferable. Most Japanese receivers using the Chinese soybeans as examples of foreign materials questioned the ability of U.S. soybeans to

Table 11.--Weight analyses of U.S. (general) soybean shipments received in Japan, 1974 1/

Month	Number of ships	Unloaded weight Metric tons	Weight shortages Metric tons	Weight shortages Percentage
January	7	167,120	1,940	1.16
February	13	232,205	2,101	.91
March	9	188,856	1,721	.91
April	14	268,612	1,625	.61
May	12	294,238	1,794	.61
June	11	271,217	1,111	.41
July	3	75,386	831	1.10
August	5	110,264	645	.59
September	6	115,308	459	.40
October	10	254,595	1,826	.72
November	8	170,142	721	.42
December	11	254,787	671	.26
Total	109	2,402,730	15,445	.64

1/ All soybeans cited in this report are in the "general" category unless specifically cited as "special."

Source: All data in this table supplied by Japanese elevators and weighing and inspection companies.

compete in the low FM. Only a limited amount of soybeans from China is available for export, and since 1974 that supply has become more limited.

The oil content (table 13) of the Brazilian soybeans most often that of the U.S. soybeans. With this quality, the Brazilian soy appear to be more desirable and present less problems to the e and the oil mill crusher in Japan. However, the Brazilian soy

Table 12.--Analyses of Brazilian soybeans received in Japan, 1973-75 1/

Year	Ship no.	Unloaded weight	Foreign material	Moisture content 2/	Oil content 2/	Nitrogen content 2/
		Metric tons	*Percent*	*Percent*	*Percent*	*Percent*
1973	1	8,800	0.46	11.40	20.50	5.92
1973	2	11,000	.88	11.50	20.15	5.80
1973	3	24,000	.90	12.52	18.50	5.77
1973	4	8,200	1.21	12.15	20.32	5.81
1974	5	9,100	.48	11.10	20.23	5.58
1974	6	9,114	1.02	10.80	21.08	5.43
1974	7	10,000	.87	11.20	20.35	5.60
1975	8	21,300	1.47	12.41	19.91	5.57
1975	9	21,336	.44	11.15	20.59	5.65

1/ All percentage data in this table represent a percentage of the total weight of soybeans.

2/ Data are on an "as is" or "wet" basis. To convert nitrogen to protein multiply by a factor of 6.25. Oil and nitrogen content data are on an "as is" basis, i.e., soybeans containing moisture content as shown under the heading of moisture.

Source: All data in this table supplied by Japanese elevators and crushing mills.

a brown stain caused by iron content in the soil which produces a darker color oil. The brown color also gets into the soybean meal used for human consumption and seriously affects its quality. Japanese analyses also indicated that the iron in the brown stain ties or binds the protein during the extraction process.

U.S. soybeans compared favorably on total nitrogen content (table 13). The higher the protein content, the better the quality of the soybean meal, both for food and feed. Furthermore, the data for Brazilian, Chinese, and U.S. soybeans show that the U.S. soybean shipments had more foreign material. Although the amount of FM in the U.S. soybeans was within the 2 percent legal limit, the percentage was higher than for either the Brazilian or Chinese soybeans.

Table 13.--Comparison of analyses of soybeans grown in the United States, Brazil, and China and received in Japan, 1973-76 1/

Year	Foreign material	Damaged beans	Splits 2/	Moisture content 3/	Oil content 3/	Nitrogen content 3/	Test weight
				U.S. soybeans			
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Pounds*
1973	1.83	2.07	10.20	12.84	18.85	5.79	55.9
1974	1.74	1.87	10.21	11.96	19.14	5.77	56.1
1975	1.77	1.44	8.12	11.95	4/ 18.24	5.77	56.4
1976	1.80	1.07	10.72	11.50	18.93	5.70	56.2
				Brazilian soybeans			
1973	.98	6.58	11.31	12.15	20.51	5.66	53.6
1974	1.08	1.51	12.40	11.39	20.38	5.71	54.8
1975	.96	2.24	12.06	11.78	20.25	5.61	54.5
1976	1.42	1.65	11.85	11.76	20.15	5.68	54.8
				Chinese soybeans			
1973	.34	.60	2.87	12.85	16.98	5.74	5/
1974	.40	.72	3.01	11.27	17.37	5.79	5/
1975	.39	.62	2.74	10.75	17.24	5.81	5/
1976	.51	.66	2,80	10.20	17.94	5.88	5/

1/ All percentage data in this table represent a percentage of the total weight of soybeans.

2/ A grade variable in U.S. Grain Inspection Manual defined as a soybean with more than one-fourth broken off.

3/ Data are on an "as is" or "wet" basis. To convert nitrogen to protein, multiply by a factor of 6.25. Oil and nitrogen content data are on an "as is" basis, i.e., soybeans containing moisture content as shown under the heading of moisture.

4/ Because of late spring frost (1974) and a long dry summer, the quality of soybeans marketed in 1975 was generally lower than in previous years.

5/ Data for test weight not available for Chinese soybeans.

Source: All data in this table supplied by Japanese elevators and crushing mills.

CONCLUSION

Analyses of the data collected indicate that although the percent of foreign material in U.S.-grown soybeans was higher than that of the soybean shipments from Brazil or China, it was still within the grade limits of U.S. Grain Inspection standards. Most of the U.S. soybean shipments to Japan required multiple deliveries at different ports, and because of the tendency of foreign material to segregate during transport, sharp differences in foreign material content were found in shipments which required multiple deliveries.

In the data assembled, oil and protein content of U.S. soybeans varied from one year to the next because of changes in weather and crop conditions. The oil and protein content of the U.S. soybeans under the period covered by this report was good. Brazilian soybeans received in Japan during this period had a little higher oil content, but U.S. soybeans showed a higher protein content. In addition, the brown dust that covered the Brazilian soybeans presented a problem to Japanese crushing mills and processors.

Insect infestation and poisonous seeds found in U.S. soybean shipments were common complaints of Japanese receivers. Rigorous Japanese customs requirements forbid any insects, and although in most instances the infestation was minimal, serious delays and cost problems were encountered by the receivers. Poisonous seeds in U.S. shipments required costly cleaning processes which often did not eliminate them. When they were not eliminated during cleaning, the quality of the oil produced was adversely affected.

Weight shortages of U.S. soybeans reported by Japanese receivers could very often be attributed to multiple deliveries where each succeeding delivery produced some weight shortages. Some of these shortages were explained by natural scale variations or by legitimate scale tolerances.

Japanese importers of U.S.-grown soybeans stated that despite the foreign materials, poisonous seeds, insect infestations, low oil content, and low protein (nitrogen) content, they would continue to buy U.S.-grown soybeans. They believe the United States is a stable and dependable source of large quantities of soybeans at competitive prices; whereas, Brazil has not been so dependable as a supply source. Also, although U.S. and Brazilian soybeans often had the same f.o.b. selling price at any one time, transport charges for comparable shipments of Brazilian soybeans were higher.